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IN THE CLAIMS

1 1. (Original) A substrate imaging system, comprising:  
2 a carrier holding a substrate;  
3 a platen holding a polishing pad;  
4 a frame for disposing the platen relative to the carrier; and  
5 an reflectance image processing subsystem for acquiring one or more two-  
6 dimensional images of the substrate during CMP of the substrate and deriving therefrom  
7 information about the substrate useful for subsequent CMP of the substrate.

1 2. (Currently amended) The system of claim 1 further comprising a means  
2 rotational device for rotating the platen.

1 3. (Currently amended) The system of claim 1 wherein the reflectance image  
2 processing subsystem further comprises a means capturing device for capturing a  
3 plurality of one-dimensional reflectance images and deriving the one or more two-  
4 dimensional images therefrom.

1 4. (Original) The system of claim 1 wherein the substrate further comprises a  
2 pad-contacting surface.

1 5. (Currently amended) The system of claim 4 wherein the reflectance image  
2 processing subsystem further comprises a means capturing device for capturing a  
3 plurality of one-dimensional images from light reflected from the pad-contacting surface,  
4 and deriving the one or more two-dimensional images therefrom.

1 6. (Original) The system of claim 1 wherein the one or more two-dimensional  
2 images comprise spectral images.

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1 7. (Original) The system of claim 1 wherein the one or more two-dimensional  
2 images are derived from data points.

1 8. (Original) The system of claim 7 wherein the data points are substantially  
2 contiguous.

1 9. (Original) The system of claim 7 wherein the data points are substantially  
2 non-contiguous.

1 10. (Original) A substrate imaging system comprising:  
2 a carrier holding a substrate, the substrate having a pad-contacting surface;  
3 a platen holding a polishing pad;  
4 a frame for operatively disposing the platen relative to the carrier; and  
5 an image processing subsystem for capturing, from light reflected from the pad-  
6 contacting surface and transmitted through one or more optically transparent elements in  
7 the platen and/or polishing pad, a plurality of one-dimensional images representative of at  
8 least a portion of the pad-contacting surface of the substrate during traversal of the  
9 opening and/or optically transparent elements, and deriving therefrom a frame  
10 comprising frame data providing information about the substrate useful for subsequent  
11 chemical-mechanical processing of the substrate.

1 11. (Currently amended) The system of claim 10 further comprising a means  
2 rotational device for rotating the platen.

1 12. (Original) The system of claim 10 wherein the one-dimensional images  
2 comprise line images.

1 13. (Original) The system of claim 10 wherein the image processing subsystem  
2 comprises a light source, a first bundle of optical fibers carrying light from the light  
3 source to the slit in the platen, and a second bundle of optical fibers carrying light  
4 reflected from the pad-contacting surface to a wavelength dispersive element for

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5 dissecting spatial components of the one-dimensional images into their respective  
6 wavelength components.

1 14. (Original) The system of claim 13 wherein the image processing subsystem  
2 further comprises a two-dimensional imager having a spatial dimension and a spectral  
3 dimension for receiving the dissected light from the wavelength dispersive element, and  
4 providing a two-dimensional collection of data for each of the one-dimensional images, a  
5 first dimension of the collection comprising a spatial dimension, and a second dimension  
6 of the collection comprising a spectral dimension, and a processor for deriving a frame  
7 from a plurality of the two-dimensional collections.

1 15. (Original) The system of claim 13 wherein the optical fibers in the first and  
2 second bundles each have terminating ends arranged in a fiber assembly element fitted to  
3 an underside of the platen.

1 16. (Original) The system of claim 15 wherein the terminating ends of the fibers  
2 are arranged in an arrangement in which terminating ends of fibers in the first bundle  
3 form first and second rows, and the terminating ends of fibers in the second bundle form  
4 a third row placed between the first and second rows.

1 17. (Original) A whole-substrate imaging system comprising:  
2 a carrier holding a substrate, the substrate having a pad-contacting surface with a  
3 maximum planar dimension;  
4 a platen having a radius and holding a polishing pad, the platen including a slit  
5 having a length equal to or exceeding the maximum planar dimension of the substrate,  
6 the length disposed substantially along the platen radius, and the polishing pad having an  
7 optically transparent element located at about the slit;  
8 a frame for operatively disposing the platen relative to the carrier, such that the  
9 pad-contacting surface of the substrate contacts the polishing pad, and substantially  
10 completely traverses the slit when the pad-contacting surface moves relative to the platen;  
11 and

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12 an image processing subsystem for capturing, from light reflected from the pad-  
13 contacting surface and transmitted through the optically transparent element and the slit,  
14 a plurality of one-dimensional images representative of the substantial entirety of the pad-  
15 contacting surface of the substrate during traversal of the pad-contacting surface past the  
16 slit, and deriving therefrom a frame comprising frame data useful for subsequent  
17 chemical-mechanical processing of the substrate.

1 18. (Currently amended) The system of claim 17 further comprising a means  
2 rotational device for rotating the platen.

1 19. (Original) The system of claim 17 wherein the one-dimensional images  
2 comprise line images.

1 20. (Original) The system of claim 17 wherein the image processing subsystem  
2 comprises a light source, a first bundle of optical fibers carrying light from the light  
3 source to the slit in the platen, and a second bundle of optical fibers carrying light  
4 reflected from the pad-contacting surface to a wavelength dispersive element for  
5 dissecting spatial components of the one-dimensional images into their respective  
6 wavelength components.

1 21. (Original) The system of claim 20 wherein the image processing subsystem  
2 further comprises a two-dimensional imager having a spatial dimension and a spectral  
3 dimension for receiving dissected light from the wavelength dispersive element, and  
4 providing a two-dimensional collection of data for each of the one-dimensional images, a  
5 first dimension of the collection comprising a spatial dimension, and a second dimension  
6 of the collection comprising a spectral dimension, and a processor for deriving a frame  
7 from a plurality of two-dimensional collections.

1 22. (Original) The system of claim 20 wherein the optical fibers in the first and  
2 second bundles each have terminating ends arranged in a fiber assembly element fitted to  
3 an underside of the platen.

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1 23. (Original) The system of claim 22 wherein the terminating ends of the fibers  
2 are arranged in an arrangement in which terminating ends of fibers in the first bundle  
3 form first and second rows, and the terminating ends of fibers in the second bundle form  
4 a third row placed between the first and second rows.

1 24. (Withdrawn) A whole-die imaging system comprising:  
2 a carrier holding a substrate, the substrate having a pad-contacting surface  
3 forming a die and having a maximum planar dimension;  
4 a rotating platen having a radius and holding a polishing pad, the platen including  
5 a slit having a length approximately equal to the maximum planar dimension of the die,  
6 the length disposed substantially along the platen radius, and the polishing pad having an  
7 optically transparent element located at about the slit;  
8 a frame for operatively disposing the rotating platen relative to the carrier, such  
9 that the pad-contacting surface of the substrate contacts the polishing pad, and  
10 substantially completely traverses the slit within a rotation of the platen; and  
11 an image processing subsystem for capturing, from light reflected from the pad-  
12 contacting surface and transmitted through the optically transparent element and the slit,  
13 a plurality of one-dimensional images representative of the substantial entirety of the pad-  
14 contacting surface of the die during traversal of the pad-contacting surface past the slit,  
15 and deriving therefrom a frame comprising frame data providing information about the  
16 die useful for subsequent chemical-mechanical processing of the substrate.

1 25. (Withdrawn) The system of claim 24 wherein the one-dimensional images  
2 comprise line images.

1 26. (Withdrawn) The system of claim 24 wherein the image processing subsystem  
2 comprises a light source, a first bundle of optical fibers carrying light from the light  
3 source to the slit in the platen, and a second bundle of optical fibers carrying light  
4 reflected from the pad-contacting surface to a wavelength dispersive element for  
5 dissecting spatial components of the one-dimensional images into their respective  
6 wavelength components.

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1 27. (Withdrawn) The system of claim 26 wherein the image processing subsystem  
2 further comprises a two-dimensional imager having a spatial dimension and a spectral  
3 dimension for receiving dissected light from the wavelength dispersive element, and  
4 providing a two-dimensional collection of data for each of the one-dimensional images, a  
5 first dimension of the collection comprising a spatial dimension, and a second dimension  
6 of the collection comprising a spectral dimension, and a processor for deriving a frame  
7 from a plurality of two-dimensional collections.

1 28. (Withdrawn) The system of claim 26 wherein the optical fibers in the first and  
2 second bundles each have terminating ends arranged in a fiber assembly element fitted to  
3 an underside of the platen.

1 29. (Withdrawn) The system of claim 28 wherein the terminating ends of the fibers  
2 are arranged in an arrangement in which terminating ends of fibers in the first bundle  
3 form first and second rows, and the terminating ends of fibers in the second bundle form  
4 a third row placed between the first and second rows.

1 30. (Original) A system for imaging a substrate during CMP, comprising:  
2 a carrier holding a substrate, the substrate having a pad-contacting surface;  
3 a rotating platen holding a polishing pad;  
4 a frame for operatively disposing the rotating platen relative to the carrier; and  
5 an image processing subsystem for capturing, from light reflected from the pad-  
6 contacting surface and transmitted through one or more optically transparent elements in  
7 the platen and/or polishing pad, data points representative of at least a portion of the pad-  
8 contacting surface of the substrate during traversal of the opening and/or optically  
9 transparent elements, and deriving therefrom one or more one-dimensional reflectance  
10 images of a portion of a substrate, where data point spacing is determined by an array of  
11 data collection locations disposed substantially non-parallel to the direction of substrate  
12 motion.

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- 1 31. (Original) The system of claim 30 where the data points used for deriving the  
2 one or more images are substantially contiguous.
- 1 32. (Original) The system of claim 31 where the data points used for deriving the  
2 one or more images are substantially non-contiguous.
- 1 33. (Currently amended) The system of ~~any of claims~~ claim 30, 31, and 32 where the  
2 one or more images are spectral images.
- 1 34. (Original) The system of claim 30 where the image processing subsystem  
2 aggregates the one-dimensional images to form a two-dimensional image of the substrate,  
3 and the two-dimensional image provides information about the substrate useful for  
4 subsequent chemical-mechanical processing of the substrate.
- 1 35. (Original) The system of claim 34 where the image processing subsystem  
2 forms one or more two-dimensional images of at least a portion of the substrate.
- 1 36. (Original) The system of claim 35 where the data points used for deriving the  
2 one or more images are substantially contiguous.
- 1 37. (Original) The system of claim 35 where the points used for deriving the one  
2 or more images are substantially non-contiguous.
- 1 38. (Currently amended) The system of ~~claims 36 or 37~~ claim 35 where the one or  
2 more two-dimensional images comprise spectral images.
- 1 39. (Original) A method for polishing a semiconductor substrate, comprising:  
2 acquiring one or more two-dimensional images of the substrate during CMP; and  
3 deriving therefrom information about the substrate useful for subsequent  
4 chemical-mechanical processing of the substrate.

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1 40. (Original) The method of claim 39 wherein the derived information  
2 comprises frame data suitable for reproducing the one or more two-dimensional images.

1 41. (Original) The method of claim 39 wherein each two dimensional image  
2 comprises a plurality of one-dimensional images, each one-dimensional image reflected  
3 from a different portion of the substrate.

1 42. (Original) The method of claim 39 wherein the one or more two-dimensional  
2 images comprise spectral images.

1 43. (Original) A method of imaging a substrate comprising:  
2 holding a substrate having a pad-contacting surface;  
3 holding a polishing pad with a platen including one or more optically transparent  
4 elements;  
5 operatively disposing the rotating platen relative to the pad-contacting surface,  
6 such that the pad-contacting surface contacts the polishing pad, and substantially  
7 completely traverses the one or more optically transparent elements within a rotation of  
8 the platen;  
9 capturing, from light reflected from the pad-contacting surface and transmitted  
10 through the one or more optically transparent elements, a plurality of one-dimensional  
11 images representative of at least a portion of the pad-contacting surface during traversal  
12 of the pad-contacting surface past the optically transparent elements; and  
13 deriving therefrom a frame comprising frame data useful for subsequent  
14 chemical-mechanical processing of the substrate.

1 44. (Original) The method of claim 43 wherein the platen comprises a rotating  
2 platen.

1 45. (Currently amended) The method of claim 43 wherein the capturing step  
2 comprises:



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3 carrying light from a light source to the optically transparent elements in the  
4 platen;  
5 carrying light reflected from the pad-contacting surface to a wavelength  
6 dispersive element; and  
7 dissecting spatial components of the one-dimensional images into their respective  
8 wavelength components.

1 46. (Currently amended) The method of claim 44 wherein the capturing step further  
2 comprises:

3 receiving, at a two-dimensional imager having a spatial dimension and a spectral  
4 dimension, dissected light from the wavelength dispersive element; and  
5 providing a two-dimensional collection of data for each of the one-dimensional  
6 images, a first dimension of the collection comprising a spatial dimension, and a second  
7 dimension of the collection comprising a spectral dimension.

1 47. (Currently amended) The method of claim 46 wherein the deriving step  
2 comprises deriving a frame from a plurality of the two-dimensional collections.

1 48. (Original) A method for acquiring a two-dimensional image of a substrate  
2 during CMP, comprising:

3 holding a substrate, the substrate having a pad-contacting surface and a maximum  
4 planar dimension;

5 holding a polishing pad with a rotating platen, the platen having a radius and  
6 including a slit having a length disposed substantially along the radius of the platen and  
7 equal to or exceeding the maximum planar dimension of the substrate, the platen also  
8 including an optically transparent element located at about the slit;

9 operatively disposing the rotating platen relative to the pad-contacting surface,  
10 such that the pad-contacting surface of the substrate contacts the polishing pad, and  
11 substantially completely traverses the slit within a rotation of the platen;

12 capturing, from light reflected from the pad-contacting surface and transmitted  
13 through the optically transparent element, a plurality of one-dimensional images

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14 representative of the substantial entirety of the pad-contacting surface of the substrate  
15 during traversal of the pad-contacting surface past the slit; and  
16 deriving therefrom a frame comprising frame data providing information about  
17 the substrate useful for subsequent chemical-mechanical processing of the substrate.

1 49. (Currently amended) The method of claim 48 wherein the capturing step  
2 comprises:  
3 carrying light from a light source to the slit in the platen;  
4 carrying light reflected from the pad-contacting surface to a wavelength  
5 dispersive element; and  
6 dissecting spatial components of the one-dimensional images into their respective  
7 wavelength components.

1 50. (Currently amended) The method of claim 49 wherein the capturing step further  
2 comprises:  
3 receiving, at a two-dimensional imager having a spatial dimension and a spectral  
4 dimension, dissected light from the wavelength dispersive element; and  
5 providing a two-dimensional collection of data for each of the one-dimensional  
6 images, a first dimension of the collection comprising a spatial dimension, and a second  
7 dimension of the collection comprising a spectral dimension.

1 51. (Currently amended) The method of claim 50 wherein the deriving step  
2 comprises deriving a frame from a plurality of the two-dimensional collections.